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(54) Folding display frame.

(57) A collapsible framework constructed of rods pivotally joined at their ends to hubs to form a self-standing unit when expanded and to fold into a small set of nearly parallel rods when folded. The hubs are designed to pivotally join the ends of four rods, with the plane defined by the pivot axes of one pair of opposing rods being offset from the plane defined by the pivot axes of the other pair of opposed rods attached to the same hub. A stab-connection latch locks two hubs together and secures the framework in the expanded position. Folding channel bars are attached to knobs on vertically aligned hubs by key-slots, the key-slots of one channel bar being of progressively shorter length going from the top-most to the bottom-most of the vertically aligned hubs to which the bar is attached.

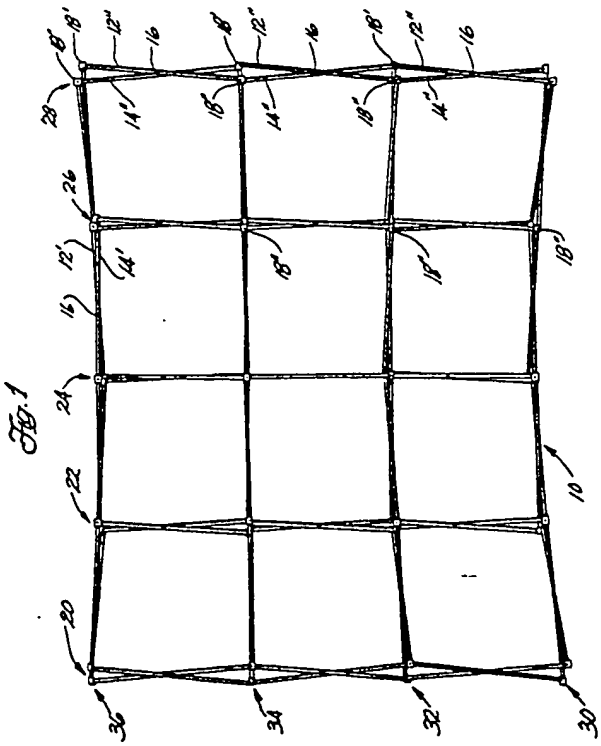

Fig. 1

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FOLDING DISPLAY FRAME

Field of the Invention

This invention relates to folding display frames, and more particularly, is concerned with a hub design for interconnecting pivotally joined rods into a frame.

Background of the Invention

Three-dimensional frameworks are well known in which a plurality of rod members are pivotally connected together to permit folding the framework into a compact closed form in which the rod members lie substantially parallel to each other. Such folding frameworks have been used for racks to support covers, panels, and the like, some in dome-shaped enclosures, in flat or curved display units, and in other types of rigid structures. Except where the framework is assembled in a substantially permanent structure, the rod members are pivotally joined at their ends to some type of hub so that the rods can be rotated relative to each other as the framework is adjusted between its open extended configuration and its closed compact storage configuration. Examples of such prior art folding frameworks are found in U.S. patents 4,471,548, 4,479,340, 4,512,097, 4,580,375 and 4,276,726.

One of the objectives of designing such frameworks is to make the structure light and compact in its folded condition to enhance the transportation and storage when the framework is not in use. At the same time, the framework, when fully extended into its useful configuration, must be strong and fairly rigid. The framework must not only be strong enough to give adequate support, but must withstand abuse, particularly when being folded and erected.

Large diameter thin-walled metal tubes normally provide maximum strength-to-weight ratios. However, the hubs to which such tubes are pivotally joined must be made light and compact to reduce the space required by the hubs when they are brought together in the collapsed configuration of the framework. In the past, attempts to utilize small hubs and thin, solid rods have resulted in a relatively fragile structure whereas use of larger diameter tubular rods have resulted in bulkier and heavier hubs.

Summary of the Invention

The present invention is directed to an improved framework design incorporating a unique hub that permits larger diameter thin-walled tubes to be pivotally connected in a strong, rigid joint. At the same time, the hub is very compact and light weight. An added advantage of the present hub design is that it allows rod members of unequal length to be incorporated into the framework's array so that the height of the array may be, for example, less than the width while still permitting the structure to be folded effectively.

In brief, the framework incorporating the features of the present invention, in its expanded or open state, consists of a grid of horizontal and vertical rod members forming an array of cubicles, each cubicle having a top, bottom and two-side frame sections, each frame section consisting of two rods or tubes pivotally joined to each other midway between their ends. The rods terminate at each end in pivotally attached hubs. Adjacent cubicles in the array share common rods and hubs. In the collapsed or closed state, the rods of each frame section are rotated with respect to each other approximately 180° so that the opposite ends are brought into proximity. The hubs are then closely packed in two groups at opposite ends of the substantially parallel rods.

Each hub is uniquely formed with a base and integrally formed flanges projecting from the base, the flanges being mutually perpendicular to each other. A tubular rod is pivotally attached at each end to a hub flange, the pivot axes of tubes secured to one pair of diametrically opposite flanges being parallel and lying in a first common plane and the pivot axes of the tubes secured to the other pair of diametrically opposite flanges also being parallel but lying in a second common plane that is parallel to but offset from the first plane.

Brief Description of the Drawings

For a better understanding of the invention reference should be made to the accompanying drawings wherein:

FIG. 1 is an elevational view of the frame in expanded position;

FIG. 2 is a top view of the expanded frame;

FIG. 3 is a top view of a frame hub;

FIG. 4 is a side view of a frame hub;

FIG. 5 is a front view of a frame hub;

FIG. 6 is a partial view in perspective showing the frame latching mechanism;

FIG. 7 is a detailed partial view of the frame in a nearly collapsed position;

FIG. 8 is similar to FIG. 7 but showing an alternate construction;

FIG. 9 shows the frame in the folded or collapsed position;

FIG. 10 is a detailed plan view of a folding channel bar; and

FIG. 11 shows the channel bar in its folded condition.

Detailed Description

Referring to FIG. 1 in detail, the numeral 10 indicates generally a folding framework shown in its open or expanded position. The framework is constructed of a plurality of pairs of rods, in the form of thin-walled metal tubes, such as indicated at 12 and 14, the rods of each pair being pivotally joined together by a hinge pin 16. The hinge pins 16 are located between the ends of the rods, allowing the rods to swivel with respect to each other in scissors-like fashion. These rod pairs are joined to form a grid-like framework, with the multiple pairs of rods being arranged in vertical columns and horizontal rows. The ends of the rods are joined by a plurality of identical hubs 18. As best shown in FIGS. 1 and 2, the framework in the expanded or open condition comprises a plurality of vertical columns, five of which are indicated respectively at 20, 22, 24, 26 and 28. These are joined by a plurality of horizontal rows, four of which are indicated at 30, 32, 34 and 36. Each of the rows, as best shown in the top view of FIG. 2, is made up of pairs of rods 12 and 14 in which the pivot connection 16 is located slightly off the center or mid position between the ends of its respective rods. Since all horizontal rods are of equal length, this causes the four pairs of rods joined in each row to assume a slightly arcuate shape. This shape gives more stability to the frame when it is resting on the floor or some other supporting surface.

The framework is locked in the expanded position shown in FIGS. 1 and 2 by a suitable latch mechanism which anchors one or more pairs of adjacent hubs 18′ and 18″ together. A preferred latch for this purpose is shown in detail in FIG. 6. One hub of the pair, such as indicated at 18, has a latch rod 40 which projects toward the adjacent hub 18″ of the pair. As the framework is expanded to its open position by moving the pairs of hubs 18′ and 18″ toward each other, the latch rod 40 engages a latch receptacle 42 which is rigidly secured to the hub 18″. The latch rod 40 enters a hole or bore 44 in the end of the latch receptacle 42 where the tapered end 46 of the rod 40 engages a spring-loaded latch pawl 48. As the latch rod is fully inserted into the bore 44, the latch pawl engages a notch 50 in the rod, securely locking the rod 40 in position in the latch receptacle 42. The pawl, which is pivotally supported to the receptacle by a pin 52 can be disengaged from the notch 50 to release the latch by pushing down on the opposite end 54 of the latch pawl 48. The pawl is urged into engagement with the notch 50 by a suitable spring 51. The latch mechanism shown in FIG. 6 need only be provided for one pair of hubs, preferably near the center of the framework grid. If greater rigidity is required, additional pairs of hubs can be provided with such a latch mechanism.

With the latch mechanisms released, the entire framework can be collapsed or folded into the storage condition, as shown in FIG. 9. In this position, the two rods 12 and 14 in each pair of such rods are rotated relative to each other about the connecting pivot 16, allowing each respective pair of hubs 18′ and 18″ to be moved apart until the rods 12 rotate almost 180 degrees relative to the other rods 14 of each pair. In the fully folded position, all the hubs 18′ move into side-by-side engagement with each other, and all the hubs 18″ also move into engagement with each other. In this way, the hubs are nested in two groups, each group, occupying an area which is limited by the size of the hubs.

In order to achieve nesting in the minimum space and make the folded framework as compact as possible, a unique hub is provided which allows the hub to be substantially reduced in size without sacrificing rigidity and strength of the framework. At the same time, the hub design of the present invention provides for ease of assembly in pivotally attaching the rods to the hubs. Details of the hub design are shown more clearly in FIGS. 3-5.

Referring to these Figures, the hub 18 is preferably molded of a suitable plastic material, but can be die-cast or otherwise formed of light weight metal. The hub is formed with a base plate 60 which is generally square in outline with the corners rounded as shown in FIG. 5, and has a flat outer surface 62 from which projects a knob or flanged pin 64. The knob 64 is used to mount various auxiliary devices to the framework.

The top surface 65 of the hub base plate 60 has four flanges or hinge plates 66, 68, 70 and 72 projecting perpendicularly therefrom. These flanges are offset from each other, as viewed in FIG. 5, so that each flange provides a flat surface, indicated respectively at 74, 76, 78 and 80. These surfaces lie in two mutually perpendicular planes. Thus, the surfaces 76 and 80 lie in a first common plane passing through the central axis 82 of the hub, while the surfaces 74 and 78 lie in a second common plane, also passing through the central axis 82 of the hub. The flanges 68 and 72 project

away from the base plate 60 a distance substantially twice that of the flanges 66 and 70. The outer projecting ends of the flanges 68 and 72, which are hereinafter referred to as "high" flanges, intersect in an enlarged central portion 84 having an opening or hole 86 into which the latch rod 40 or latch receptacle 42 may be press-fitted or otherwise secured. High flanges 68 and 72 are provided with holes 88 and 90 adapted to receive a pivot pin or rivet 91 which pivotally secures the end of a tubular rod to the hub flange. The axes of the holes 88 and 90 are parallel to each other and lie in a common plane.

Similarly, the flanges 66 and 70, referred to as the "low" flanges of the hub, are provided with holes 92 and 94 that are adapted to receive the hinge pins or rivets 91 associated with additional tubular rods. The axes of the holes 92 and 94 are parallel to each other and lie in a common plane. The plane of the holes 92 and 94 is offset from the plane of the holes 88 and 90 by a distance "A". The backsides of the high flanges 68 and 72 are undercut, as indicated at 96 and 98, respectively, to provide clearance for the ends of the rods pivotally attached to the low flanges as the rods are rotated about the axes of the holes 92 and 94.

As best seen in FIG. 6, the high and low flange arrangement of each hub, as described above, allows for the ends of four relatively large tubular rods to be pivotally attached to each hub by rivets 91. The offset "A" allows ready access to all the rivets 91 of each hub by suitable riveting equipment. Also, the flange configuration allows the outer perimeter of the base plate 60 to be made approximately equal to twice the diameter of the tubular rods, thus permitting the hubs to be made extremely compact and to nest against each other in two groups in the folded condition of the framework, as illustrated in FIG. 9.

Another advantage of the high, low flange arrangement of the hubs is that the rods in the horizontal rows can be of a different length than the rods in the vertical columns while still permitting the hubs to nest in two coplanar groups when the framework is in its folded position. This feature can be best understood by reference to FIG. 7, which shows a portion of the framework in a substantially folded position. As the framework is expanded into its open position by moving the hubs 18' toward the hubs 18", the pair of rods 12' and 14' rotate into the horizontal rows as shown in FIG. 1 while the rods 12" and 14" rotate into the vertical columns of the framework. Thus, the spacing between the hubs in the horizontal rows is determined by the length of the rods 12' and 14' while the distance between the hubs in the vertical columns is determined by the length of the rods 12" and 14". If, as shown in FIG. 7, all of the horizontal rods 12' and 14' are pivotally joined to the low flanges of the hubs 18, and all the vertical rods 12" and 14" are pivotally connected to the high flanges of the hub 18, it becomes necessary for the vertical rods to be made shorter in length than the horizontal rods in order for the hubs in each of the two folded groups (see Fig. 9) to be coplanar. In fact, as seen in FIG. 7, the rods 12" and 14" are shorter, by an amount equal to 2A, than the horizontal rods 12' and 14'. As a result, when the framework is expanded to the open position, the openings or cubicles are not square but are rectangular, with the vertical dimension of each cubicle being smaller than the horizontal dimension by an amount substantially equal to 2A. Thus, the high, low flange arrangement of the hubs allows the designer to modify the width-to-height ratio of the erected or expanded framework. It should be noted that if it is desired to construct the framework with all of the rods being of identical length, this can be accomplished merely by rotating the hubs 18' 90° relative to the hubs 18". This causes the high flange of the hubs 18' to be aligned with a low flange of the hubs 18" so that every rod is pivotally joined at one end to a low flange and at the other end is pivotally joined to a high flange. This alternative arrangement is shown in FIG. 8.

In order to attach panels of heavy fabric or other materials to the face of the framework after it is erected, it is desirable to attach vertical channel bars to the framework along each of the vertical rows of rods. In the past, these channel bars have been made up in individual sections corresponding to the height of each cubicle and the frame. The one feature of the present invention is an improved channel bar in which the sections are hinged together so that the channel bar can be attached as a unit or folded for storage. The channel bar is shown in FIGS. 10 and 11 and includes three sections 80, 82 and 84. The sections 80 and 82 of the channel bar are joined by a link 86 pivotally attached to a hinged member 88 secured to the bar section 80 and a hinged member 90 secured to one end of the bar section 82. Similarly, the channel bar section 82 is connected to the channel bar section 84 by a hinge including a link 92 pivotally attached to a hinged plate 94 secured to the channel bar section 82 and a hinged plate 96 secured to the channel bar section 84. The link 86 is longer than the link 92, allowing the channel bar section 82 to be folded between the channel bar sections 82 and 80 in the manner shown in FIG. 11.

The three sections of the channel bar are attached to the front of the framework by four key slots indicated at 100, 102, 104 and 106. The key slots 102 and 104 are formed in the hinged members 90 and 96 respectively while the key slots 100 and 106 are formed in blocks 108 and 110 secured

to the respective ends of the channel bar. The key slots are open at one end and are arranged to engage knobs 64 on the front of the hubs of the framework. To simplify the assembly of the channel bar to the framework, the k y slots are made progressively shorter from the top to the bottom of the channel bar as the key slot 100 is longer than the slot 102, the key slot 102 is longer than the slot 104, and the key slot 104 is longer than the slot 106. This simplifies the assembly of the framework and channel bars since the keys slots can be engaged with one knob at a time starting at the top. Thus, with the key slot 100 at the top of the channel bar engaged with the top knob of a column, the channel bar assembly can be lifted sufficiently to engage the key slot 102 at the next lower knob without disengaging the longer key slot 100. Similarly, the key slot 104 can be engaged with a knob without disengaging the slot 102. When so attached to the frame, the channel bars form a continuous vertical strip to which panels can be attached for covering the framework with a smooth, continuous display surface.

From the above description, it will be recognized that the improved display framework has been provided which can be made very compact and lightweight.

Claims

1. A folding framework comprising:

a plurality of pairs of rods, each pair of rods being pivotally joined to each other at an intermediate point;

a plurality of hubs, the respective ends of each rod being pivotally joined to one of said hubs, each hub having a plurality of said rods pivotally joined thereto;

the pivotal connection of each rod to a hub providing rotation of the rod relative to the hub about a single axis of revolution;

rods connected to any one hub being rotatable about said axes from a closed position in which all the rods are substantially parallel to each other to an open position in which the rods radiate away from each other;

the axes of revolution of two of the rods connected to a single hub being

substantially parallel to each other and lying substantially in a first plane,

the axes of revolution of another two of the rods connected to said single hub being

substantially parallel to each other and lying substantially in a second plane,

the second plane separate from and substantially parallel to the first plane.

2. Apparatus of claim 1 wherein all the rods are of equal length and each rod is connected at one end at a pivotal connection in said first plane of the associated hub and is connected at the other end at a pivotal connection in said second plane of the associated hub.

3. Apparatus of claim 1 wherein the rods are of a first length or a second length, the difference in length being twice the distance between said first and second planes.

4. Apparatus of claim 1 wherein, in said open position, the rods connected to each hub extend outwardly substantially perpendicularly to each other, whereby the rods and associated hubs form a rectangular lattice.

5. Apparatus of claim 2 wherein, in said open position, the rods connected to each hub extend outwardly substantially perpendicularly to each other, whereby the rods and associated hubs form a rectangular lattice.

6. Apparatus of claim 3 wherein, in said open position, the rods connected to each hub extend outwardly substantially perpendicularly to each other, whereby the rods and associated hubs form a rectangular lattice.

7. Apparatus of claim 1 further including stab connector means mounted on at least one pair of hubs, the stab connector means including a male member rigidly mounted on and projecting from one of said pair of hubs and a female member rigidly mounted on and projecting from the other of of said pair of hubs, the male and female members telescopically engaging when the hubs are moved into the open position of the folding frame, and a releasable catch on one of said members engaging the other of said members to lock the telescopically engaged members together.

8. In a folding open framework comprising a plurality of pivotally joined pairs of rod members in which four of said pairs of rod members are pivotally joined at their ends by eight hub members to form four sides of a rectangular cubicle having a hub at each of the eight corners of the cubicle, a plurality of said cubicles forming an array with adjoining cubicles sharing a common pair of rod members and the associated four hubs at each of the ends of the pair of rod members, the improvement comprising:

hub members formed with first and second flanges projecting from a common base at an angle to each other, each flange having at least one rod member pivotally attached thereto for rotation of the rod member about an axis of revolution extending perpendicular to and adjacent to one end of the rod member, the axes of revolution being offset from each other and non-intersecting

9. Apparatus of claim 8 wherein said first and second flanges are perpendicular to each other.

10. Apparatus of claim 8 wherein the rod members pivotally attached to the first of said hub flanges are longer than the rod members pivotally attached to the second of said hub flanges, the difference in length being equal to twice the amount of offset of the associated axes of revolution.

11. The apparatus of claim 9 wherein the rod members are all of equal length.

12. Apparatus of claim 8 further including stab connector means mounted on at least one pair of hubs, the stab connector means including a male member rigidly mounted on and projecting from one of said pair of hubs and a female member rigidly mounted on and projecting from the other of of said pair of hubs, the male and female members telescopically engaging when the hubs are moved into the open position of the folding frame, and a releasable catch on one of said members engaging the other of said members to lock the telescopically engaged members together.

13. Apparatus of claim 9 wherein the hubs on at least one side of the framework include a flanged knob projecting therefrom, a bar having a plurality of key slots spaced along the bar at intervals corresponding to the distance between knobs, for engaging the knobs of aligned hubs, whereby the bar is removably secured to a plurality of hubs, each successive key slot being shorter in length than the adjacent key slot whereby the bar can be engaged one knob at a time to the aligned hubs.

14. Apparatus of claim 13 wherein the bar includes a plurality of sections and hinge means securing each section to an adjacent section, whereby the bar can be folded when not secured to the knobs.

15. Apparatus of claim 12 wherein the hubs on at least one side of the framework include a flanged knob projecting therefrom, a bar having a plurality of key slots spaced along the bar at intervals corresponding to the distance between knobs, for engaging the knobs of aligned hubs, whereby the bar is removably secured to a plurality of hubs, each successive key slot being shorter in length than the adjacent key slot whereby the bar can be engaged one knob at a time to the aligned hubs.

16. Apparatus of claim 15 wherein the bar includes a plurality of sections and hinge means securing each section to an adjacent section, whereby the bar can be folded when not secured to the knobs.

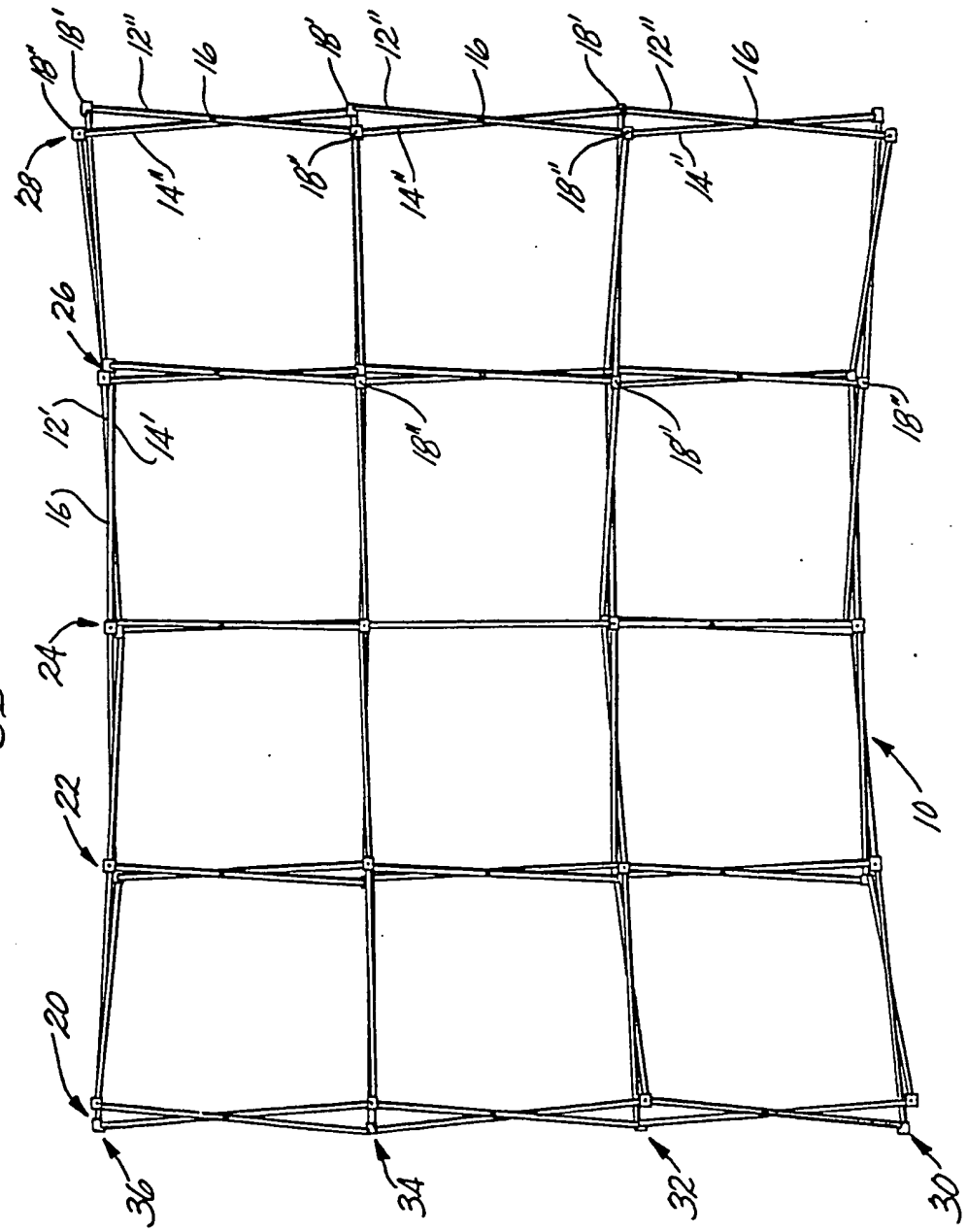


Fig. 1

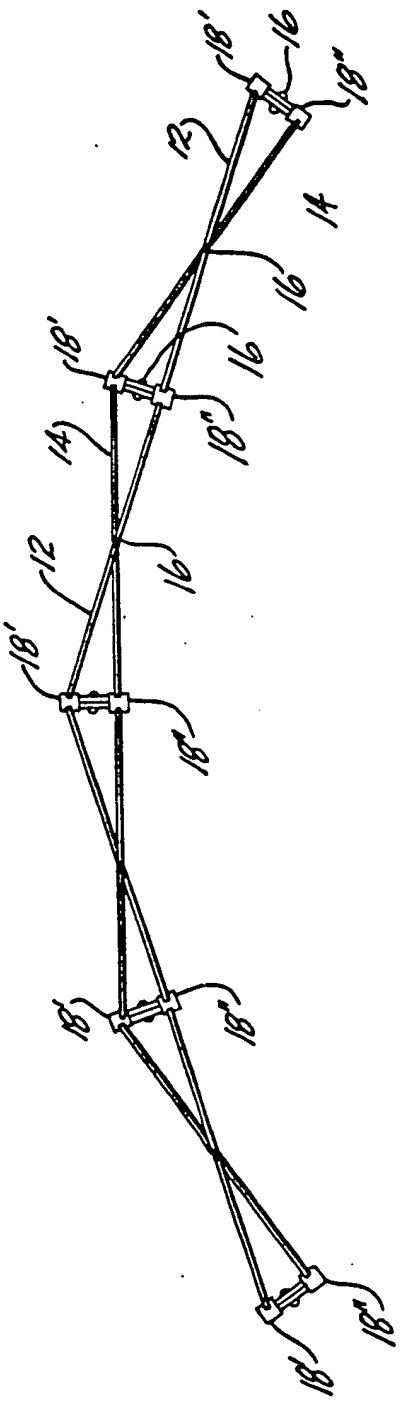


Fig. 2

Fig. 3

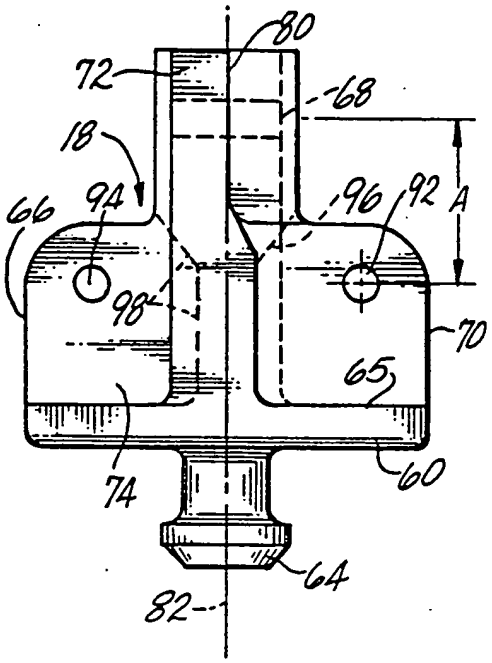


Fig. 4

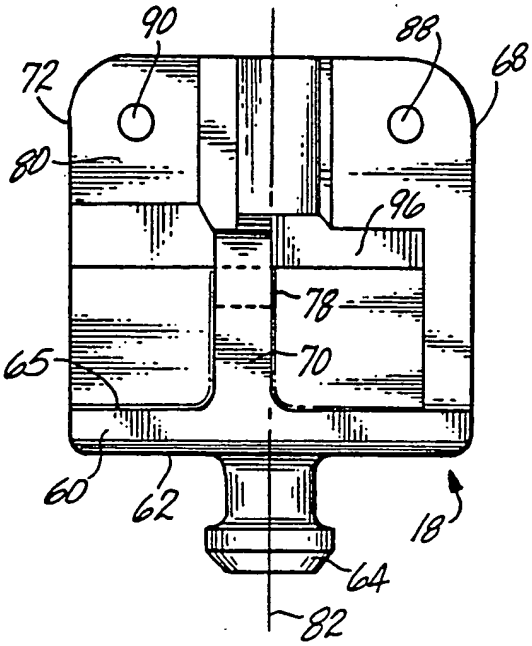


Fig. 5

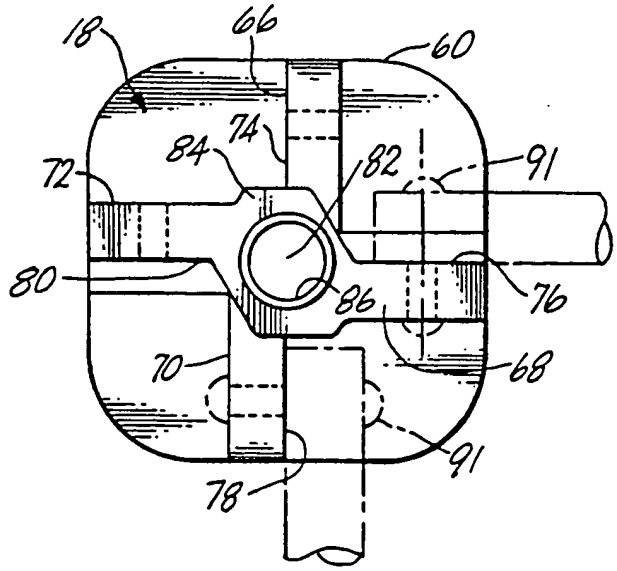


Fig.6

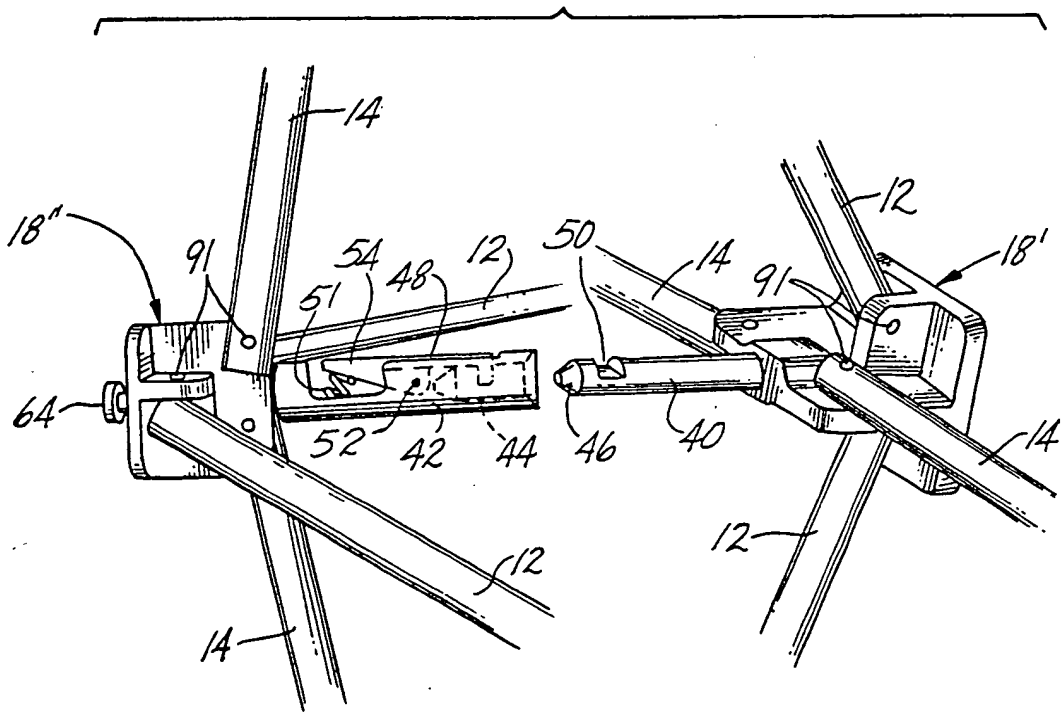


Fig.7

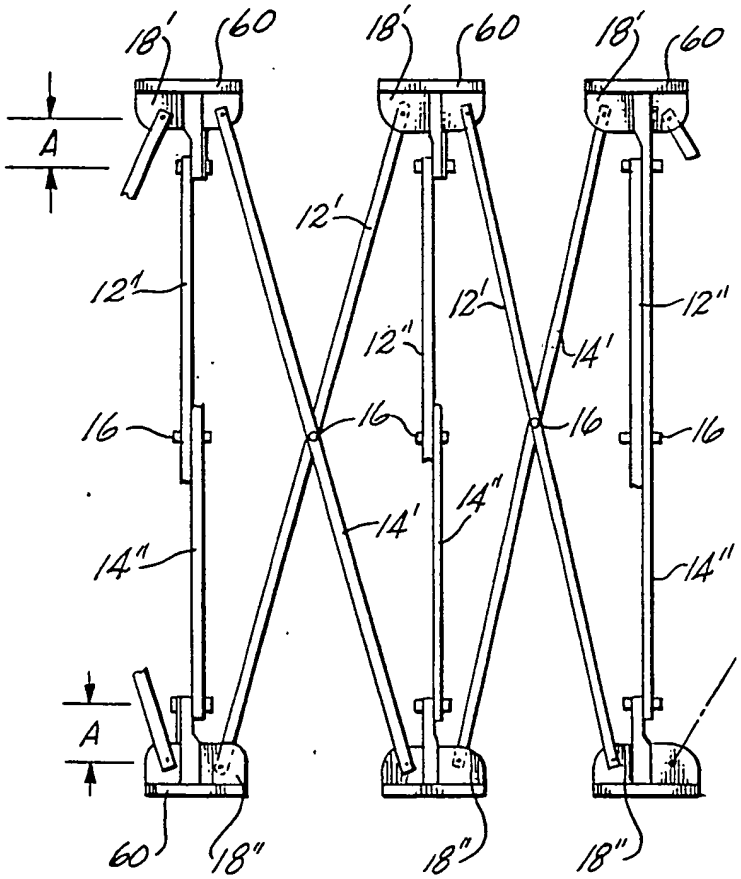


Fig. 8

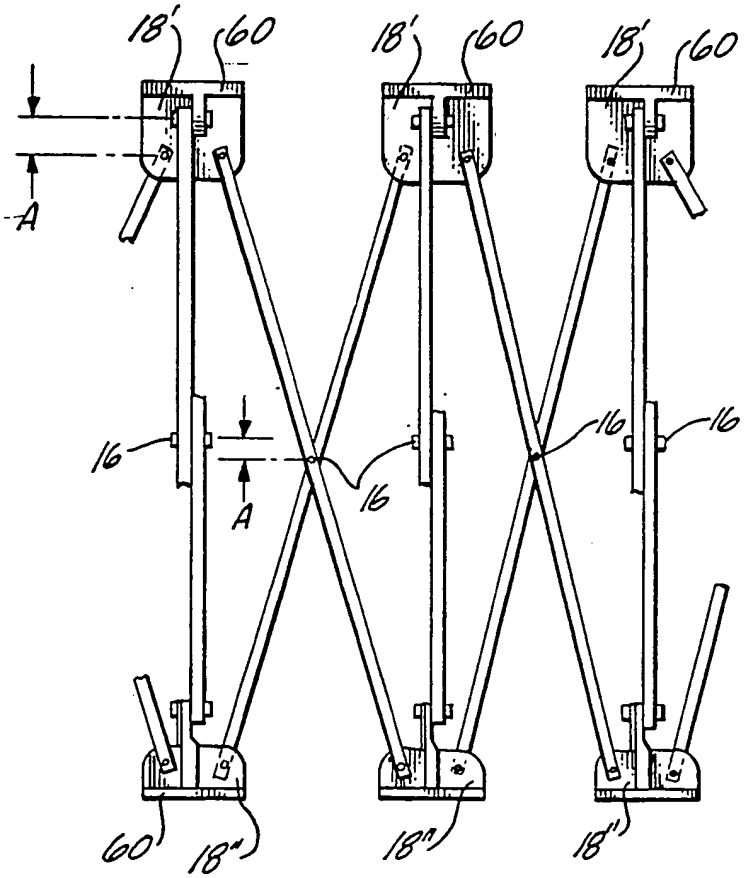
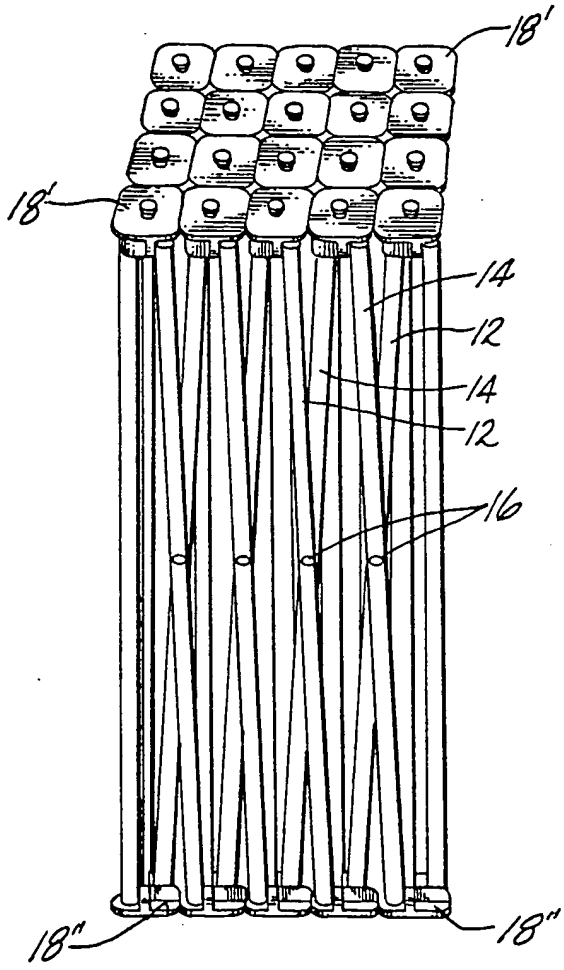


Fig. 9



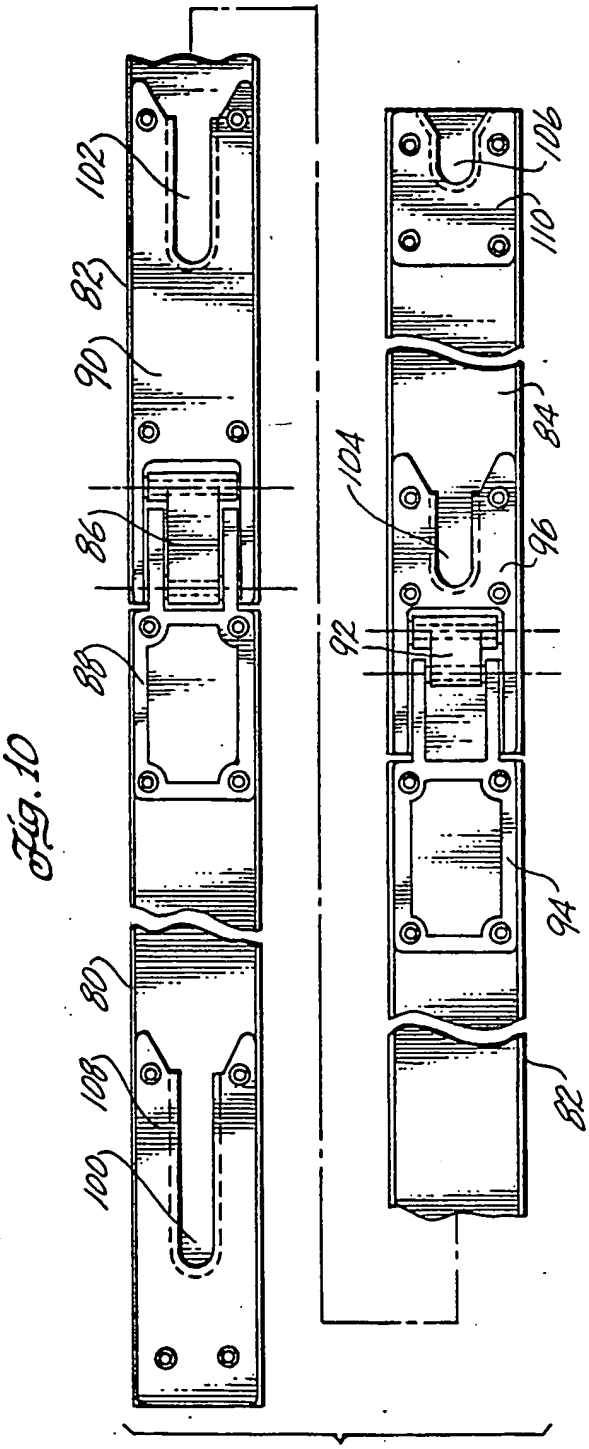


Fig. 10

Fig. 11

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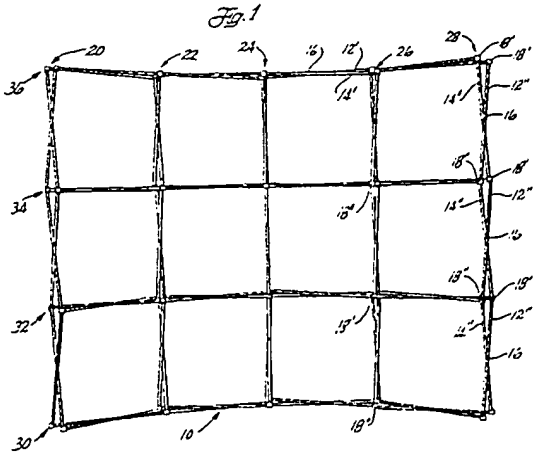
(54) Folding display frame.

(57) A collapsible framework (10) constructed of rods (12,14) pivotally joined at their ends to hubs (18) to form a self-standing unit when expanded and to fold into a small set of nearly parallel rods when folded. The hubs (18) are designed to pivotally join the ends of four rods (12,14), with the plane defined by the pivot axes of one pair of opposing rods being offset from the plane defined by the pivot axes of the other pair of opposed rods attached to the same hub (18). A stab-connection latch (40,42) locks two hubs together and secures the framework in the expanded position. Folding channel bars (80,82,84) are attached to knobs (64) on vertically aligned hubs by key-slots (100-106), the key-slots of one channel bar being of progressively shorter length going from the top-most to the bottom-most of the vertically aligned hubs to which the bar is attached.

Fig. 1



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EUROPEAN SEARCH REPORT

Application Number

EP 87 11 8267

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
D,A	US-A-4 479 340 (E. ALPHONSE et al.) * complete document *	1	E 04 B 1/344 G 09 F 15/00
D,A	US-A-4 276 726 (DERUS) * complete document *	1	
D,A	US-A-4 471 548 (GOUDIE) * complete document *	1	
D,A	US-A-4 512 097 (ZEIGLER) * complete document *	1	
A	WO-A-8 401 094 (NODSKOV et al.) * complete document *	1	
A	EP-A-0 106 016 (ZEIGLER) * complete document *	1	

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

E 04 B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	18-05-1990	PAETZEL H-J

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